Strategy Research Project

ENERGY SECURITY: REDUCING VULNERABILITIES TO GLOBAL ENERGY NETWORKS

BY

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In the age of globalization the vulnerability of energy networks, particularly oil and gas networks, has increased due to multiple factors, the least of which include: the presence of non-state, transnational terrorist networks, political and economic aims of emerging states, and the overall interdependence on global energy sources. These vulnerabilities have revealed the extreme fragility of these networks and the mere presence of threats to these networks causes disruptions to the flow of resources and leads to instabilities in the global markets and the world economy. The effects of these disruptions are felt almost immediately and are worldwide. Current energy security policies do not adequately address these vulnerabilities. This paper examines the vulnerabilities global energy networks and provides recommendations for developing a new energy security policy that mitigates the threats and increases resiliency in energy networks.

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ABSTRACT

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In the age of globalization the vulnerability of energy networks, particularly oil and gas networks, has increased due to multiple factors, the least of which include: the presence of non-state, transnational terrorist networks, political and economic aims of emerging states, and the overall interdependence on global energy sources. These vulnerabilities have revealed the extreme fragility of these networks and the mere presence of threats to these networks causes disruptions to the flow of resources and leads to instabilities in the global markets and the world economy. The effects of these disruptions are felt almost immediately and are worldwide. Current energy security policies do not adequately address these vulnerabilities. This paper examines the vulnerabilities global energy networks and provides recommendations for developing a new energy security policy that mitigates the threats and increases resiliency in energy networks.

ENERGY SECURITY: REDUCING VULNERABILITIES TO GLOBAL ENERGY NETWORKS

> America has always risen to great challenges, and our dependence on oil is one of the greatest we have ever faced. It's a threat to our national security, our planet, and our economy.
>
> —Barack Obama[1]

In July 1979 following years of U.S. economic instability, record unemployment, and rising inflation, mostly brought on by fuel shortages resulting from the 1973 Arab oil embargo followed by the 1979 Iranian revolution, President Jimmy Carter stated in his now famous *Crisis of Confidence* speech: "In little more than two decades we've gone from a position of energy independence to one in which almost half the oil we use comes from foreign countries…This intolerable dependence on foreign oil threatens our economic independence and the very security of our nation…It is a clear and present danger to our nation."[2] Nearly 30 years later, Admiral Dennis Blair, Director of National Intelligence, testified before The Senate Select Committee on Intelligence that the [ongoing] global economic crisis and its geopolitical implications are the primary near-term security concerns for the United States, ahead of the spread of violent extremism, proliferation of weapons of mass destruction, and the growing threat of cyber-terrorism. In his testimony, Admiral Blair cites the instability in oil prices, projected energy shortages, and corresponding protracted global recession as the major causes of the economic crisis.[3] Energy security and securing our nation's continued access to energy resources has long been a predominant national security issue. But, for the most part, the existing policies have been inadequate and shortsighted, particularly now and in the future where we expect global demand for energy resources to increase by 50 percent by 2030.[4] Prior to his recent appointment as the National Security Advisor, General

James L. Jones, USMC (Ret.) stated in a memorandum to then President-elect Obama: "Energy is a national security issue, and it is an international security issue of the highest order."[5]

Energy security first became an issue of national security just prior to World War I when the (then) First Lord of the Admiralty Winston Churchill, in an effort to out-pace the emerging German navy, decided to change the British naval ships from coal-powered to oil. This historic decision was the turning point for energy security, for from this point on, Great Britain would be dependent upon foreign sources of fuel and its national security strategy would be intertwined with the necessity to secure these sources to fuel their navy. Although energy security is still a predominant part of national security, the context from which it initially emerged at the dawn of World War I has changed significantly.

American society and our way-of-life are dependent upon a continuous supply of energy. Beginning in the eighteenth century with predominately abundant wood supplies and shifting in the mid-1800's to coal, Americans have continuously enjoyed easy access to sources of energy. When shortages or difficulties rose in the production and supply of domestic energy sources, the American public and industries switched to a more available source. An example of this occurred in the years following the 1910 discovery of oil in Texas and the 1919 nationwide coal strike during which our dependence on energy shifted from coal to oil and gas.[6] The advent of low-cost automobiles and widespread electricity networks rapidly fueled our quest for more sources of energy, and by the early 1950s the United States became a net importer of energy resources to provide for our ever-increasing thirst. Today our entire way of life

centers on the need for a constant flow of energy. From fuels to heat our homes and run our cars to electrical power to run virtually every facet our businesses, we are entirely dependent on ensuring a continuous flow of energy. Any shortage or disruption in this flow can and often does create a crisis, which affects our lives. The fragility of these energy systems poses a threat not just to our national security but also to our way of life. The effects of a great rise in the worldwide energy trade, geopolitical rivalries, threats of global terrorism, instability of export nations, and emerging economies necessitate a much wider approach to energy security; much wider than even the current energy policies.

The accepted definition of energy security is "the availability of sufficient supplies at affordable prices"[7] Accordingly, the term and definition of "energy security" can mean different things to different groups. For example, to many Americans, including most of our nation's leaders, energy security has meant "energy independence" or producing energy domestically and reducing our dependence on foreign sources of energy. However, to the Chinese energy security means acquiring uninterrupted access to foreign oil fields or "security of supply." In Russia, it means something entirely different. To a Russian, energy security means limiting access to Russian oil and gas reserves to foreign investment or "security of demand." This paper will examine energy security and its' vulnerabilities from a historical, strategic, environmental, and economic perspective and offer recommendations to the new administration on how it should proceed with a new national energy security policy to both reduce our dependency of foreign sources of energy and to reduce our vulnerabilities to disruptions in the flow of energy. Because petroleum products are the most prevalent source of global energy

today, this paper will focus primarily on the vulnerability oil and gas production and availability.

The roots of the United States' energy security policy emerged following the 1973 oil crisis during which the Organization of Arab Petroleum Exporting Countries (OAPEC) proclaimed an oil embargo on the United States for our support to Israel during the Yom Kippur War. The embargo led to a rise in oil prices from $3 to $12 a barrel and set a path to a series of recessions and inflation, which lasted until the early 1980s. President Richard Nixon in his address to the nation on the (new) National Energy Policy on November 7, 1973 stated: "Let us unite in committing the resources of this nation to a major new endeavor…that by the end of this decade we will have developed the potential to meet our own energy needs without depending on any foreign energy sources."[8] As a result of the oil crisis, the U.S. Government instituted a number of initiatives to reduce our dependency on foreign oil resources including the establishment of the Department of Energy. The Energy Policy and Conservation Act of 1975 imposed Corporate Average Fuel Economy (CAFE) standards for automobiles, and the creation of the U.S. Strategic Petroleum Reserve. For the next 30 years subsequent administrations sought to improve on President Nixon's *Project Independence* with various programs and incentives, mostly geared towards energy conservation and reducing America's dependence on foreign energy sources. All the while, our developing economy, with its corresponding thirst for abundant commercial access to energy and its ever-increasing transportation needs grew at a proportional rate.

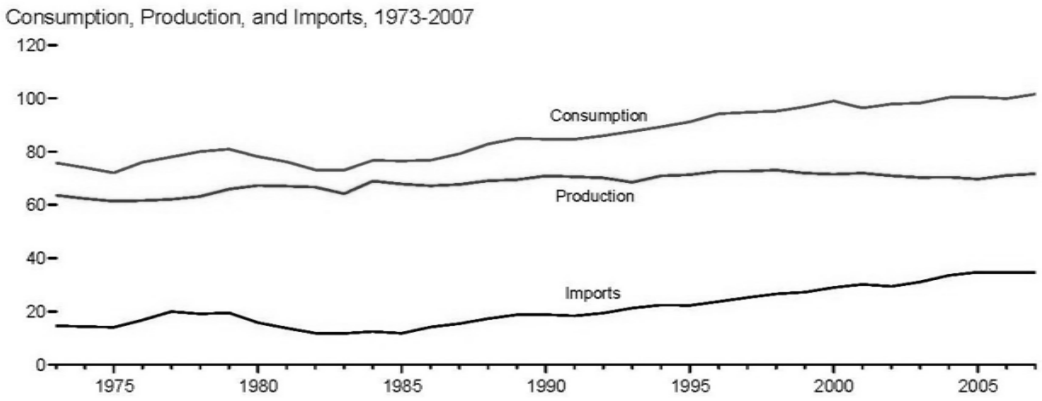

Figure 1. Energy Consumption, Production, and Imports, 1973-2007[9]

In 1973 U.S. energy imports, which included crude oil, natural gas, and coal, accounted for only 19 percent of consumption, while in 2008, 33 percent of U.S. consumption was from energy imports.[10] The U.S. consumption of energy only rose 24 percent from 1973 to 2008 while total energy imports rose over 55 percent.[11] So, despite President Carter's declaration of a "clear and present danger" to our national security, our government's efforts over the past 30 years to reduce consumption and relieve our dependence on foreign sources of energy have actually seen an overall increases across the board. However, all is not doom-and-gloom, over the past five years, both consumption rates and import rates have stabilized. In fact, the total 2008 energy imports and consumption rates are the lowest since 2003.[12] Some of this "leveling-off" of imports and consumption can be attributed to one of the most recent pieces of legislation regarding energy, the Energy Policy Act of 2005. Signed into law by President Bush in August 2005, this $12.3 billion Energy Act has attempted to meet the challenges of a growing energy deficit by introducing some new efficiencies and providing further incentives to domestic energy production (both alternative energy

sources and petroleum production). Proponents of the Act have called it "an energy strategy for the 21st Century." While opponents have decried the Act as simply providing additional breaks to "big oil" and "driven by political expediency, rather than the practical disciplines of sound program management."[13] Nevertheless, some aspects of this legislation has spurned renewed interest in alternative fuels, too include nuclear energy. Since the law's inception there have been 9 permits issued for the construction of new nuclear facilities, with the first new reactor in 20 years expected to come on-line in 2016.[14]

Another key piece of recent legislation regarding energy is the Energy Independence and Security Act of 2007. Signed into law by President Bush on December 19, 2007, this Act raises auto fuel economy standards, establishes a national standard for generating electricity from renewable energy sources and requires increased use of biofuels. This bill was largely supported by environmental groups for its focus on clean sources of energy (in fact, it was originally called the Clean Energy Act of 2007). However, some portions of the act actually contradicted or repealed the provisions of the Energy Policy Act of 2005, particularly in the area of incentives and restrictions on the petroleum industry. In a memorandum to members of congress Mr. R. Bruce Josten, the Chairman of the U.S. Chamber of Commerce stated: "This legislation is part of a continuing effort to penalize an industry that has brought immense economic wealth to the United States and its citizens. Congress and various Administrations have perhaps imposed more regulations on the oil and gas industry than any other industry in the United States."[15]

Overall, most of the energy policies enacted by the U.S. government over the last 35 years have been centered upon energy independence and conservation, with varying degrees of success. As stated, despite an overall increase in both consumption and imports since 1973, there has been, at least in the past five years, a trend towards leveling-off of energy use nationwide. Regardless, of the recent trends however, the U.S. policies for energy have done little to stem the tide of our dependence on foreign imports and have done very little to reduce our vulnerability to energy systems disruptions.

Strategic Vulnerabilities

Our dependence on foreign sources of energy, particularly oil, is intertwined with our participation and competition in the global energy markets. Until recently, the United States was the world's largest consumer of foreign energy sources. Today's global demand for oil has grown to seven million barrels per day, two million of which is imported by China.[16] China's oil demand has increased by 30 percent over the last seven years and beginning in 2005, Asia surpassed the North America in total oil consumption.[17] Some studies suggest that by 2020 China's demand for oil will double and they will likely import 70 percent of their energy needs.[18] The impact of China's growth, coupled with growing demand elsewhere has led to the tightest energy markets since the late 1970s.

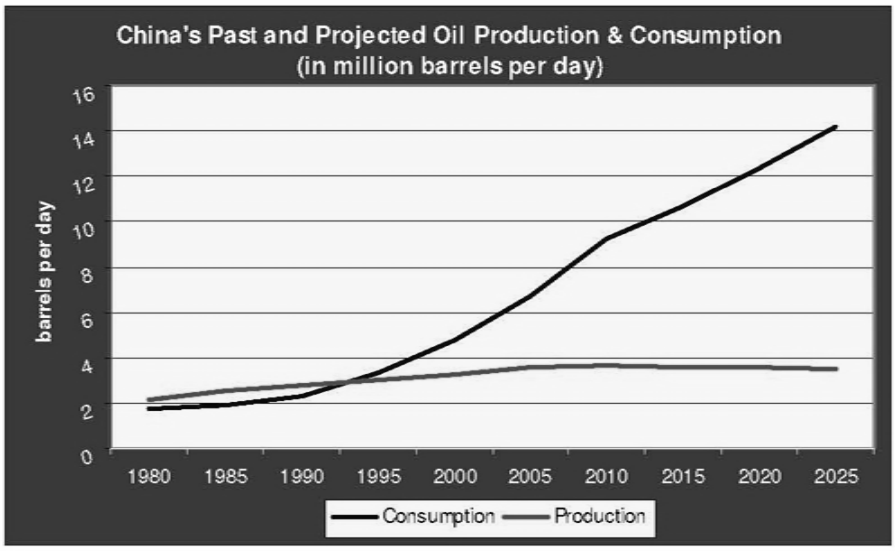

Figure 2: China's Past and Projected Oil Production and Consumption (in million barrels per day)[19]

Nowhere is China's quest for dominance in the world energy markets more evident than in Africa. China's approach in Africa has been to establish strategic, long-term bilateral relationships to ensure long-term access to energy resources. China has developed diplomatic and economic relationships with many African nations who have been cited for human rights violations and corruption. China's dealings with these governments reflect their policy of non-interference in another countries internal affairs. In Sudan, the third largest producer of crude oil in sub-Saharan Africa, China is the leading developer of the country's oil reserves and imports 60 percent of Sudan's oil output. Despite a United Nation's accusation of genocide in the Darfur region, Beijing has reportably provided the Sudanese government with nearly $20 billion in loans, grants, and other forms of aid, to include sales of jet fighters and Chinese assistance in building weapons factories. Additionally, recent estimates by PFC Strategic Studies Institute shows that Sudan could receive more than $30 billion in oil revenues over the

next three years. In Ethiopia, despite the ongoing genocidal war against the indigenous Anuaks, China's Zhongyuan Petroleum Prospecting, a subsidiary of the China Petrochemical Corporation, is the primary oil firm operating in Gambella. Nigeria is the leading oil producer in Africa and the 11th largest oil producer in the world. And although 80 percent of the government's revenues are derived from oil, over 70 percent of the population lives in poverty. In 2005, the China National Offshore Oil Corporation signed an $800 million contract with Nigeria, which ensures China will receive 30,000 bpd of crude oil. Additionally, China will provide nearly $4 billion in infrastructure improvements reportably in exchange for future drilling rights in the Nigeria delta region. Africa's second largest oil producer, Angola, is China's largest trading partner on the continent. In 2005 China provided over $2 billion in aid to Angola in exchange for agreements to provide long-term oil supplies to China's Sinopec and other future drilling options. China maintains and develops oil deals in every oil-producing African country and it is estimated that it receives nearly 701,000 bpd from Africa. This accounts for about 30 percent of China's oil imports. China expects to increase this amount by 25 percent in the next 10 years.[20]

Simply put, the hegemonic position in the world energy markets the United States had enjoyed over the past 50 years is decreasing and we now find ourselves as, at least, a peer competitor in obtaining sources of energy.

Terrorist Threats

In addition to the vulnerability to energy security from competition in global markets, the threat of non-state, transnational terrorist organizations to disruptions in the flow of energy resources is a continuing and rising vulnerability to America. In 2004

Osama bin Laden stated in a video address to his organization: "We bled Russia for ten years until it went bankrupt and forced to withdraw in defeat. We are continuing the same policy to make America bleed profusely to the point of bankruptcy."[21] At the time, oil prices were at $38 per barrel. Bin Laden's overall goal, as originally stated in a 1998 interview, was to raise oil prices to over $144 per barrel. Ten years ago this was seen as a somewhat preposterous statement, but just this past year we saw oil prices raise to $133 per barrel.[22] This past year's rise in oil prices is not directly due al Qaeda or any other recognized transnational threat, but a combination of strong demand from Asia, speculation, geological decline, and (the main culprit) OPEC's reluctance to increase production.[23] However, the record oil prices were perceived as a major victory and morale booster to bin Laden's organization.

Terrorist attacks on energy infrastructure remain as a significant threat to disruptions in the world's energy supply. The attacks on Saudi Arabia's Abqaiq oil processing facility on February 24, 2006, if successful, would have resulted in the greatest disruption to oil supplies in history. Estimates from four to six million barrels of oil per day would have been removed from the market, resulting in a loss of nearly 7 percent of the world's demand.[24] In Iraq, attacks on oil pipelines until recently, kept nearly 1 million bpd of oil off the market. Some experts estimate that this loss alone resulted in an increase of $10 to $15 per barrel of oil. Paradoxically, the threat of attack on oil infrastructure in the Middle East has, in part, led to rising oil prices and a windfall for countries in the region where 70 percent of the world's oil supplies are found. The terrorist organizations benefit greatly from this windfall as Middle Eastern petrodollars

find their way to jihadist organizations through Muslim charities and government subsidies to religious organizations.

The vulnerability of energy networks to terrorist attacks is most evident in Nigeria. In the oil-rich Nigerian delta region, the Movement for the Emancipation of the Niger Delta (MEND) has conducted attacks on energy infrastructure resulting the complete shutdown of production in some facilities and delays in repairs in others. These disruptions have thus far resulted in losses approaching 40 percent of Nigeria's oil output capacity.[25]

Transportation Vulnerabilities

The need to transport energy resources between export regions and consuming regions raises concerns and realizes vulnerabilities to certain geographic choke points. Tanker ships transport over half of the world's oil and gas on fixed maritime routes. The world energy markets are dependent upon these routes to remain open to the passage of tankers. Many of these routes contain key straits, which emerge as critical vulnerabilities of the energy distribution network. The control over these vulnerable choke points have led to new regional and international security challenges. In addition to the threat of blockage of the straits, the oil tankers are also vulnerable to terrorist attacks, piracy, and political unrest from neighboring countries. The Strait of Hormuz connects the Persian Gulf with the Gulf of Oman and the Arabian Sea and is recognized as the most critical oil chokepoint. Approximately 40 percent of the world's seaborne oil transits the Strait of Hormuz every day.[26] The threat that Iran could close off the Strait of Hormuz by mining the straits at it's narrowest point or sinking tankers in the shipping lane using it's abundant and forward-positioned anti-ship cruise missiles looms in every

analysis. In a recent article in the *International Security Journal*, Caitlin Talmadge concludes about the Iranian threat to the Strait of Hormuz: "Iranian closure of the Strait of Hormuz tops the list of global energy security nightmares…Extended closure of the strait would remove roughly a quarter of the world's oil from the market, causing a supply shock of the type not seen since the glory days of OPEC."[27] The Strait of Malacca is the key energy transit chokepoint in Asia. Located along the shortest sea route between the Persian Gulf suppliers and Asian markets, approximately 15 million barrels of oil per day transit the Strait of Malacca and an estimated 50 percent of China's imported oil.[28] The greatest threat in Malacca is piracy. However, a recent report by the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP) shows a significant decrease in incidents of piracy in the Straits of Malacca and Singapore from 2004 (43 incidents) to 2008 (10 incidents).[29] The decrease in piracy incidents is attributed to the enhanced maritime security cooperation agreements between the Asian nations patrolling the straits.

Environmental Vulnerabilities

The concentration of Carbon Dioxide (CO_2) in the earth's atmosphere is at the highest level now than at any time in the last 650,000 years and has risen over 35 percent since the early 1800's.[30] The high CO_2 concentration has resulted in a global temperature rise of over 1.8 degrees Fahrenheit in the last century. Many experts agree that the burning of fossil fuels for energy production is responsible for nearly 70 percent of the global warming issues and the burning of oil, in particular, is blamed for about 42 percent of the CO_2 emissions.[31] Left unchecked, the impacts of global warming could result in sea-level rise, coastal flooding, increased severity of flooding,

storms and heat waves, drought, massive species extinction, and the pandemic spread of diseases. [32] These hazards bring to the forefront a significant vulnerability to energy security and the continued use of fossil fuels for energy sources. Can the United States (and the world) continue to rely on oil and gas as the primary source of energy without jeopardizing our environment and, potentially, the future of mankind? An analysis by Exxon-Mobile shows that CO_2 emissions are expected to increase by 1.6 percent per year through 2030. Currently, the largest source of CO_2 emission comes from the power generation sector, 24 percent at 10 billion metric tons per year. These emissions are expected to increase to 15 billion metric tons per year by 2030.[33] The largest share of CO_2 emissions comes from coal-fired power generation plants. In China, the use of coal in power generation has doubled in the last eight years and their demand for coal is expected to continue to grow.[34] China's CO_2 emissions from coal are projected to grow to 9.6 billion metric tons (51 percent of the world's CO_2 emissions) by 2030.[35]

Meteorological Hazards

The Gulf of Mexico region accounts for over 25 percent of the United States' oil production and about 14 percent of the natural gas. This region's vulnerability to severe weather, particularly Hurricane Katrina in August 2005 followed by Hurricane Rita in September 2005 resulted severe, long-lasting disruptions to the flow of energy sources to the United States. The cumulative losses as a result of these two hurricanes were 109 billion barrels of oil (20 percent of the annual production) and 15 percent of the annual natural gas production. During Hurricane Rita nearly 100 percent of the Federally-administered Gulf of Mexico daily oil and gas production was shut down. Nearly 6.9 million barrels of refinery capacity was lost when on-shore refineries were

shut down as a result of the storms.[36] Additionally, the long-lasting effects of the hurricanes included over 113 platforms destroyed and another 52 significantly damaged. This extraordinary disruption to the oil and gas production caused President Bush to authorize the expenditure of 9.8 million barrels of oil from the Strategic Petroleum Reserve.[37]

The August 2003 Blackout which affected the Northeastern United States and portions of Ontario, Canada highlights the vulnerability of the electrical power networks. The blackout affected nearly 50 million people and shut down over 531 generating units at 263 power plants across the region, including 10 nuclear plants. The blackout began at about 2:00 P.M. on August 14, 2003 and power was not restored for most customers for two days. According to the final report issued by the North American Electrical Reliability Corporation, the initial cause of the blackout was the disabling of a malfunctioning monitoring system by an operating engineer at a power plant in Ohio. Shortly afterwards, a series of transmission lines tripped off-line because of tree contact. The lines were sagging due to the heat of the day and additional load from residential power demands. Because the monitoring system was disabled the operator was unable to accurately assess the problem.[38] The cascading series of outages and faults ultimately resulted in one of the largest power outages in U.S. history, contributed to at least 11 deaths, and cost the utility companies and their customers over $6 billion dollars. Also as a result of this incident, the Federal Energy Regulatory Commission, as directed by the Energy Policy Act of 2005, would mandate 96 new reliability standards for utility companies in an effort to improve operator training and performance.[39]

The energy system failures in the Gulf of Mexico and northeastern North America highlight the fragility of our energy networks and the inability of these networks to absorb disruptions. Despite controls emplaced as a result of historical failures, many energy networks lack redundancies and remain vulnerable to catastrophe. One analysis of the structural vulnerability of the North American Power Grid concluded that a removal of only two percent of the high-load nodes would create a cascading system failure resulting in a shut down of 60 percent of the entire grid.[40]

Economic Vulnerabilities

Although the cause our nation's on-going economic crisis cannot be directly attributed to energy security, the availability and pricing of energy resources impacts on our economic health. In the 1970's the vulnerability of our economy to disruptions in the energy system showed in record unemployment and factory shutdowns. The resulting economic stress was demonstrated in the diminished economic growth, which decreased from 3.7 percent per year in the 1950s and 1960s to only 2.7 percent in the 1970s.[41] In this case, the deep recessions and high inflation were a direct result of disruptions to energy resources caused by the 1973 OPEC embargo, the 1976 natural gas shortages, the 1978 nation-wide coal strike, and the 1979 gasoline shortages.[42] The ever-growing capitol requirements for energy production threaten investment in other sectors of the economy. This fact, combined with the high costs of producing synthetic fuels and other alternative sources of energy clearly have contributed to today's economic crisis. In his book *The Pentagon's New Map* Thomas P. M. Barnett describes how economic growth is tied to energy consumption. "An advanced economy like the United States can achieve one percent growth in GDP while increasing its

energy use less than one percent. An emerging economy, like China, will – on average – grow its economy and energy use at roughly a one-to-one rate. But most poor economies require more than a percent increase in energy consumption for every percent of economic growth."[43] This relationship between a country's economic growth and the availability of energy resources highlights the economic vulnerability of nations, particularly those with growing economies, to world energy markets and their ability to compete. It is easy to see how a country can get into economic trouble by even the slightest disruption in energy supplies.

President Obama's Energy Plan

President Barack Obama's plan for energy security calls for "…a sustained and shared effort by our government, our businesses, and the American people."[44] His plan, which he outlined during his 2008 campaign for president, is designed to reduce our dependence on foreign oil, address the environmental challenges of energy consumption, and set the conditions for a clean energy future.

The short-term solutions to the President's plan are meant to provide Americans with immediate relief from rising energy costs. The solutions include:

- An Emergency Energy Rebate of up to $1000 per family paid for through windfall profit taxes on oil company profits.
- Enacting legislation to close the loopholes in commodities futures trading and excessive energy speculation that led to the skyrocketing oil prices during the summer of 2008.

- Releasing light crude from our Strategic Petroleum Reserve to bring down prices of refined products and replacing it with heavy crude more suited for our-long term needs.[45]

The long-term energy solutions confront two main issues, global climate change and dependency on foreign sources of oil:

- Implement an economy-wide cap-and-trade system to reduce carbon emissions by 80 percent by 2050. Basically, this solution will force industries to pay for their carbon emissions. The receipts generated will support the development of clean energy and investment in energy efficiency.
- The United States will take the lead in engaging the U.N. Framework Convention on Climate Change (UNFCC) to address the climate problem.
- Invest $150 billion over ten years to accelerate the production of plug-in hybrid vehicles, promote renewable energy sources, invest in low-emission coal plants, advance technologies in bio-fuels, and begin the transition to a new digital electricity grid.
- Increase vehicular fuel economy standards by 4 percent per year, enabling the savings of nearly 500 billion gallons of gasoline and reducing greenhouse gas emissions by 6 billion metric tons over ten years.
- Provide a $7000 tax credit to the purchasers of hybrid/flexible-fuel vehicles in an effort to put one million of these advanced technology vehicles on the road by 2015. Additionally, provide $4 billion retooling tax credit to domestic auto manufacturers to produce new fuel-efficient cars.

- Significantly increase domestic oil and gas production by encouraging oil companies to drill on the 68 million acres of land and 40 million acres offshore that they already have access to. Additionally, promote the domestic production of oil and gas by reducing or eliminating obstacles to drilling in previously federally restricted areas such as the National Petroleum Reserve-Alaska.
- Accelerate the construction of Alaska Natural Gas Pipeline. With a capacity of 4 billion cubic feet of natural gas per day, this pipeline could feed seven percent of current U.S. consumption. $18 million in guaranteed loans were authorized in 2004, but no progress has been made in its construction.
- Utilize Enhanced Oil Recovery (EOR) methods to maximize the recovery of oil that remains in existing fields. Using this technology, which involves injecting CO_2 into underground oil fields, experts believe that up to 85 billion barrels of oil can be recovered.
- Develop safe long-term solutions for the disposal of spent fuel and nuclear waste from nuclear power plants in an effort to promote increased development of nuclear energy sources.
- Pursue major investment through the Smart Grid Investment Matching Grant Program for our national utility grid to improve our electric grid reliability and security. Enable smart metering, distributed storage, and other advanced technologies by establishing a Grid Modernization Commission to facility the adoption of Smart Grid practices across the nation.[46]

We are beginning to see some of this plan take shape. In the recent American Recovery and Reinvestment Act, the Department of Energy (DOE) received $39 billion, nearly double last years entire DOE budget. In President Obama's 2010 budget, recently presented to congress, he provides the DOE another $26.3 billion, which includes money for renewable energy, smart grid programs, and technology for capturing carbon-emissions.[47] Additionally, the Recovery Act provided $8 billion for transportation improvements, a key piece of President Obama's energy plan.

Many proponents of President Obama's energy plan tout it as an aggressive, comprehensive plan to reduce our dependence on foreign sources of energy, particularly the Middle East and Venezuela. However, some critics argue that the plan is not much more than a "warmed-over" plan like those presented by the Carter and Clinton administrations. Right up front, President Obama's plan relies upon the oil companies "record-breaking windfall profits" to provide the funding for a $1000 rebate for every American family. In an article published by the *Cato Institute* in 2006, senior fellows Jerry Taylor and Peter Van Doren argue that windfall profits taxes are not a very good revenue source for the government. In fact, they argue that windfall profits in the oil sector are figments of the imagination.[48] While raw earning numbers coming from the oil companies may appear enticing, actual profit margins are some of the lowest in industry. The returns on invested capitol in the oil and gas industry from 1973 to 2003 were less than the national industrial average for the same 30-year period.[49] In the last quarter of 2005, the 20 largest oil companies earned only an average of 8.8 percent, compared to, for example, the computer industry which saw profit margins of 22.7 percent (Apple Computer) or Intel (24 percent).[50] Additionally, the drop in profit margins

and increase taxes not only scares away future investors, but also reduces the capitol the oil companies require for expanding future production.

Other critics argue that the plan does not put much emphasis the nuclear industry and its potential to provide a clean (alternative) source of energy. France, for example, realizes 39 percent, the largest share, of consumed energy and 75 percent of their electricity from nuclear energy and has seen a 50 percent decline in its oil consumption since 1973.[51] But, the biggest criticism of the plan is that, although comprehensive in domestic actions necessary to increase efficiency, improve domestic production and reduced consumption, it falls short in the realization that we will still be dependent on foreign sources of energy far into the future. The Energy Information Administration (EIA) projects that total U.S. consumption of energy will rise by nearly 11 percent by 2030.[52] The EIA model, which takes into account an increased use of bio-fuels, demand reductions resulting from new efficiency standards, and increased domestic energy production, shows the net import share of U.S. consumption actually drops from 29 percent in 2007 to 17 percent in 2030.[53] But, the fact remains; by 2030 we will still be importing 8.79 million barrels of oil per day.[54] A national energy security plan must include policies for stabilizing and competing within the world energy markets and reducing our vulnerability to disruptions in global energy flow. It should not focus as much on energy *independence* as it should on energy *interdependence*.

Recommendations for a National Energy Security Policy

A truly comprehensive National Energy Security Policy should include as its tenants: diversification of supply, resilience, integration, and information.

Diversification of Supply. By simply increasing the sources from which we derive our energy demands we can reduce the vulnerability to disruptions in the supply-chain. This diversification can take many forms. From alternative sources of energy, such as bio-fuels, wind, solar, and nuclear energy to unconventional sources, such as oil sands, coal-bed methane, oil shale, and gas hydrates to traditional sources such as Enhanced Oil Recovery (EOR) technologies and multilateral drilling.[55] Today only 7 percent of our total energy consumption comes from alternative sources.[56] The continued exploration of unconventional sources has the potential to significantly increase our diversity of domestic production. The Bakken Formation in Montana, North Dakota and Saskatchewan, Canada, for example, contains 3.65 billion barrels of technically recoverable oil shale.[57] In addition to diversification in the technologies of sources, there is also the necessity to diversify among the import partners. Currently, the United States imports oil from 66 countries worldwide. However, the top ten countries account for 87 percent of all crude oil imports with Canada, Saudi Arabia, Mexico, Venezuela, and Nigeria as the top five import countries.[58] By diversifying our sources we reduce the vulnerability of one or more of these sources being disrupted.

Resilience. Key to addressing energy security is through system-wide resiliency. In his book *Brave New War*, John Robb describes his theory of Dynamic Decentralized Resilience as the ability to dynamically mitigate and dampen system shocks.[59] In order to achieve resilience in a system it must be configured to ensure that intentional or naturally occurring disruptions do not cause considerable damage or complete destruction. Resilience normally comes from many factors, including adequate spare production capacity, strategic reserves, backup supplies of equipment, adequate

storage capacity along the supply chain, and plans for responding to disruptions.[60] But, resilience can also mean creating systems that are transparent, two-way, and open.[61] For example, to truly make an electricity network resilient, it would first need to be more transparent, that is, the utility company would merely be the manager of the network, like today's Powershares Exchange (PJM) and not the maker of electricity.[62] The electricity network would be two-way, whereby any individual or company on the network could be both a producer and a consumer of power. Finally, the electricity network would be open so that local providers can add services such as power conditioners or increased power storage for use in a power outage. Throughout the United States there has been significant progress towards making electrical transmission and distribution networks more resilient. The Oak Ridge National Laboratories, in conjunction with the Department of Energy's Office of Electricity Delivery and Energy Reliability is conducting research into the areas of high temperature superconductivity, visualization and controls, energy storage, and distributed systems all in an effort to improve the resiliency of the electrical grid system.[63] Additionally, our on-going efforts to transform to Smart Grid technologies will certainly enhance the resilience of our electrical grid. The Smart Grid will transform the electrical industry from a centralized, producer-controlled network to a less centralized, more consumer-interactive energy network.[64]

Integration. Oil is a global commodity and the price of a barrel of oil is based upon the worldwide supply and demand. Events and disruptions in the supply and demand in one country affect the prices worldwide. Even if we did not import a single barrel of oil from the Middle East, events in the Middle East would have an impact on

how much Americans pay for gasoline. Any future National Energy Security Policy should embrace our *interdependence* in energy markets and not a pipedream of energy *independence*. A portion of our American diplomacy should focus on the stability of energy supplying nations. For example, diplomatic engagements with China and India, two of the fastest growing energy consumers in the world, should focus on helping them improve their efficiencies and reduce their consumptions. We should open our doors and provide them with the technologies on renewable fuels and unconventional sources of energy. As David H. Yergin, author of *The Prize: The Epic Quest for Oil, Money, and Power* stated: "Improving fuel efficiency in China could do more to protect our national security, fight global warming, and promote economic growth than securing additional supply from the Persian Gulf."[65]

Information. A new National Energy Security Policy should include the requirement to participate in high-level information sharing between global energy producers and consumers. Sharing information is the key to well-functioning markets and reduces the vulnerability to consumer panics during actual or feared disruptions, particularly during a crisis. The International Energy Agency (IEA) is an organization that was created following the 1973 oil crisis for just this purpose. The IEA, with its 28 member nations, seeks to balance national energy policies, ensure energy security, and promote economic development and environmental protection. The IEA has as it founding objectives:

- To maintain and improve systems for coping with oil supply disruptions
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organizations

- To operate a permanent information system on the international oil market
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use
- To promote international collaboration on energy technology
- To assist in the integration of environmental and energy policies[66]

The United States would be well served to participate fully in the information sharing among the members of the IEA and also by encouraging non-members, such as China, Russia, and India to participate. Additionally, through the IEA, the United States can promote relationships with domestic and international energy producing companies by increasing its communications and the exchange of information. Reducing the vulnerability of the panic set-off by disruptions of energy supplies by simply collaborating with our global partners can greatly ensure our energy security.

Conclusion

Since 1973 our nation's energy policies have centered around reducing energy consumption, improving efficiencies, and reducing our dependence on foreign sources of energy. Yet, despite our efforts, our thirst for more energy continues to grow. Most of our policies to this point have ignored the fact that we will not become independent of foreign sources in the near future and that even minor disruptions in our energy flow have serious implications to not only our economy, but to our way of life. Energy security and reducing our vulnerabilities should be a top priority for the new administration. But, energy security involves more than just conservation, it must be intertwined with our National Security Strategy. It should focus on energy interdependence rather than independence. As Daniel Yergin stated: "In a world of

increasing interdependence, energy security will depend much on how countries manage their relations with one another…That is why energy security will be one of the main challenges for U.S. foreign policy in the years ahead."[67] Any new National Energy Security Policy should, as its tenants, focus on diversity of supply, resilience, integration, and information. Using these tenants, we could realize our goals of energy security, in the context of energy interdependence, and reduce our vulnerabilities to the threats to our economy, our national security, and our planet.

Endnotes

[1] Barack H. Obama and Joseph Biden, "Obama Biden: New Energy for America," August 3, 2008, http://my.barackobama.com/ page/content/newenergy (accessed March 5, 2009).

[2] James E. Carter, "Primary Sources: The "Crisis of Confidence" Speech," *PBS: American Experience,* July 15, 1979, http://www.pbs.org/wgbh/amex/ carter/filmmore/ps_crisis.html (accessed February 22, 2009).

[3] Dennis C. Blair, "Annual Threat Assessment of the Intelligence Community," *Statement for the Record* (February 12, 2009) Washington, D.C.: Senate Select Committee on Intelligence, 2009. 1.

[4]Energy Information Administration, *Annual Energy Outlook 2009* (Washington, DC: Energy Information Administration, 2009), 22.

[5] James L. Jones, *A Transition Plan for Securing America's Energy Future,* Institute of 21st Century Energy (Washington, D.C.: U.S. Chamber of Commerce, 2008), 2.

[6] The mining industry in the United States had peaked by about 1910 and the discovery of oil at Spindletop in eastern Texas in 1910 also quickened the transition to oil and gas.

[7] Daniel Yergin, "Ensuring Energy Security," *Forgein Affiars* 85, no. 2 (Mar/Apr 2006): 70.

[8] Richard M. Nixon, "Address to the Nation About Policies to Deal With the Energy Shortage." *Research Center: Public Papers of President Nixon.* November 7, 1973, http://www.nixonlibraryfoundation.org/clientuploads/directory/archive /1973_pdf_files/1973_0323.pdf (accessed February 22, 2009). 1.

[9] Energy Information Administration, *Monthly Energy Review January 2009* (Washington, D.C.: Energy Information Administration, 2009), 1.

[10] Ibid., 3.

[11] Ibid.

[12] In 2004 the total energy imports were 33.543 (Quadrillion Btu) and consumption was 100.351 (Quadrillion Btu). In 2008 the total energy imports were 33.013 (Quadrillion Btu) and consumption was 99.896 (Quadrillion Btu). Energy Information Administration. *Monthly Energy Review January 2009.*

[13] Ronald R. Cook, “The Energy Policy Act of 2005: Legislative Achievement or Management Fiasco?” August 29, 2005, http://globalpublicmedia.com/articles/478 (accessed February 22, 2009).

[14] Energy Information Administration, "Status of Potential New Commercial Nuclear Reactors in the United States." July 17, 2008, http://www.eia.doe.gov/ cneaf/nuclear/page/nuc_reactors/com_reactors.pdf (accessed February 22, 2009).

[15] R. Bruce. Josten, "H.R. 6, The Clean Energy Act of 2007," *U.S. Chamaber of Commerce: 2007 Letters to Congress,* January 17, 2007, http://www.uschamber. com/issues/letters/2007/070117_clean_energy_act.htm (accessed February 22, 2009).

[16] Yergin, "Ensuring Energy Security." 71.

[17] Ibid.

[18] Kenneth Lieberthal and Mikkal Herberg, "China's Search for Energy Security: Implications for U.S. Policy," *NBR Analysis* (The National Bureau of Asian Research) 17, no. 1 (April 2006): 11-12.

[19] Cindy Hurst, *China's Oil Rush in Africa,* Institute for the Analysis of Global Security, Potomac, MD: IAGS, 2006.

[20] Ibid.

[21] Osama bin Laden, "The Full Version of Osama bin Laden's Speech: October 29, 2004." *The Middle East Media Research Institute* (November 5, 2004) http://memri.org/bin/ latestnews.cgi?ID=SD81104 (accessed March 1, 2009).

[22] Energy Information Administration, *Short-Term Energy Outlook.* Monthly, (Washington, DC: Energy Information Administration, 2009). 1.

[23] Gal Luft. "Breaking Oil's Monopoly in the Transportation Sector." *Senate Testimony by Dr. Gal Luft on July 22, 2008.* Senate Committee on Homeland Security and Governmental Affairs, 2008.

[24] Gal Luft, "An Energy Pearl Harbor?" *The Washington Post*, March 5, 2006.

[25] John Robb, *Brave New War: The Next Stage of Terrorism and the End of Globalization* (Hoboken, NJ: John Wiley & Sons, 2007), 83.

[26] Energy Information Administration, "World Oil Transit Chokepoints." *Country Analysis Briefs,* January 1, 2008. http://www.eia.doe.gov/cabs/World_Oil_ Transit_Chokepoints/pdf.pdf (accessed March 1, 2009).

[27] Caitlin Talmadge, "Closing Time: Assessing the Iranian Threat to the Strait of Hormuz," *International Security* (Massachusetts Institute of Technology) 33, no. 1 (Summer 2008): 82.

[28] Energy Information Administration. "World Oil Transit Chokepoints."

[29] Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP), *Annual Report 2008*, Information Sharing Centre, (Singapore: ReCAAP ISC, 2008). 14.

[30] Worldwatch Institute and the Center for American Progress, *American Energy: The Renewable Path to Energy Security,* (Washington, DC: Worldwatch Institue, 2006), 19.

[31] David B. Sandalow, *Ending Oil Dependence: Protecting National Security, the Environment and the Economy.* Opportunity 08: Independent Ideas For Our Next President, (Washington, DC: Brookings Institution, 2008), 5.

[32] Worldwatch Institute and the Center for American Progress, *American Energy: The Renewable Path to Energy Security.* 19.

[33] National Petroleum Council. *Hard Truths: Facing the Hard Truths About Energy,* (Washington, DC: National Petroleum Council, 2007), D-28.

[34] Energy Information Administration. *International Energy Outlook 2008* (Washington, DC: Energy Information Administration, 2008), 9.

[35] Ibid., 94.

[36] Energy Information Administration, "Short- Term Energy Outlook Supplement: The 2008 Outlook for Hurricane Production Outages in the Gulf of Mexico," June 1, 2008, http://tonto.eia.doe.gov /FTPROOT/forecasting/2008_sp_03.pdf (accessed March 1, 2009).

[37] U.S. Department of Energy, *Strategic Petroleum Reserve: Annual Report for Calendar Year 2007* (Washington, DC: DOE, 2007), 17.

[38] U.S.-Canada Power System Outage Task Force, *Interim Report: Causes of the August 14th Blackout in the United States and Canada* (Washington, DC: U.S.-Canada Power System Outage Task Force, 2003),

[39] J.R. Minkel, “The 2003 Northeast Blackout--Five Years Later,” August 13, 2008, http://www.sciam.com/article.cfm?id=2003-blackout-five-years-later (accessed March 1, 2009).

[40]Robb, *Brave New War: The Next Stage of Terrorism and the End of Globalization,* 105.

[41] John D. Sterman, *Economic Vulnerabilty and the Energy Transition,* PhD Thesis (Cambridge, MA: Alfred P. Sloan School of Management, Massachusetts Institute of Technology, 1982), 3.

[42] Ibid.

[43] Thomas P. M. Burnett, *The Pentagon's New Map: War and Peace in the Twenty First Century* (New York, NY: Berkley, 2004), 201.

[44] Obama. "Obama Biden: New Energy for America."

[45] Ibid.

[46] Ibid.

[47] U.S. Office of Management and Budget*, Budget of the United States Government, Fiscal Year 2010,* February 26, 2009, http://www.whitehouse. gov/omb/budget/ (accessed March 6, 2009).

[48] Jerry Taylor and Peter Van Doren, *Cato Institute,* April 26, 2006, http://www.cato.org/pub_display.php?pub_id=6370 (accessed March 5, 2009).

[49] Ibid.

[50] Ibid.

[51] EnerPub, “France: Energy Profile,” June 08, 2007, http://www. speroforum. com/site/article.asp?idarticle=9839&t=France%3A+Energy+profile (accessed March 5, 2009).

[52] Energy Information Administration. *Annual Energy Outlook 2009*. 9.

[53] Ibid.

[54] Ibid., 13.

[55] In multilateral wells the main wellbore is drilled to above the reservoir and then one or more wellbores, branching off of the main wellbore, are drilled into the target zone.

[56] Energy Information Administration. *Annual Energy Outlook 2009*. 13.

[57] Energy Information Administration, “This week in Petroleum,” March 4, 2009, http://tonto.eia.doe.gov/oog/info/twip/twip.asp (accessed March 5, 2009).

[58] Energy Information Administration, “December 2008 Import Highlights,” February 27, 2009, http://www.eia.doe.gov/pub/oil_gas/petroleum/data _publications/company_level_ imports/current/import.html (accessed March 6, 2009).

[59] Robb, *Brave New War: The Next Stage of Terrorism and the End of Globalization,* 164.

[60] Yergin, "Ensuring Energy Security." 76.

[61] Robb, *Brave New War: The Next Stage of Terrorism and the End of Globalization,* 173-174.

[62] PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. PJM's acts independently and impartially in managing the regional transmission system and the wholesale electricity market. PJM ensures the reliability of the largest centrally dispatched grid in North America. PJM's members include power generators, transmission owners, electricity distributors, power marketers and large consumers. From PJM website: http://www.pjm.com/about-pjm/who-we-are/company-overview.aspx (assessed March 15, 2009).

[63] Oak Ridge National Laboratory, "Energy Efficiency and Renewable Energy," *Electricity Delivery and Energy Reliability,* July 10, 2008, http://www.ornl.gov/sci/ees/ factsheets/fs_oe.pdf (accessed March 15, 2009).

[64] U.S. Department of Energy, "The Smart Grid: An Introduction," September 10, 2008, http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_ Book_Single_Pages.pdf (accessed March 5, 2009). 10.

[65] Yergin, "Ensuring Energy Security." 81.

[66] International Energy Agency, "About the IEA," September 25, 2008, http:// www.iea.org/about/index.asp (accessed March 6, 2009).

[67] Yergin, "Ensuring Energy Security." 82.